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Reservoir operation in assigning optimal multi-crop irrigation areas

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ABSTRACT

A mathematical model is developed for the optimal multi-crop irrigation areas associated with reservoir operation policies in a reservoir-irrigation system. Optimal area allocations are considered by addressing an appropriate mathematical model. The reservoir operations are related to releases policy, monthly water allocations, and occasional reservoir spills in a monthly operating time. The objective is to maximize the annual benefit of the system by supplying irrigation water for a proposed multi-crop pattern over the planning period. Herein, three sets of constraints are applied to the system: achieving monthly balance in the reservoir, covering water demand for crop production, considering evaporation loss from the reservoir, and governing equations for reservoir release and operations. The provided model is formulated with these constraints linked together by appropriate additional constraints as a linear programming model. Sensitivity analysis of inflow and alternative irrigation policies is conducted to investigate their effect on the final results. The methodology is applied to a real case study of a reservoir-irrigation system in Iran to show the applicability of the model.

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1. Introduction

Optimization of irrigation systems for existing areas and improvement in water resource allocations by appropriate multi-cropping patterns and irrigation scheduling are the best response to reduce water deficits. Irrigation scheduling deals with two basic questions: when and how much to irrigate?

Because of an ever-increasing demand for irrigation water and the unreliability of stream flow in arid and semi-arid regions, performance evaluation of reservoir operation is important and particularly difficult. Generally, optimal multi-cropping pattern and irrigation areas associated with appropriate reservoir operation and irrigation scheduling are essential for increasing the overall efficiency of reservoir-irrigation systems. The most important aspect of operations is the release of the right quantity of water at the right time to irrigation areas to achieve greater benefits. The most promising aspects that arise in the system monitoring and evaluation

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